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BRIEFING

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Compliance with India's first fuel-consumption standards for new passenger cars (FY 2017–2018)

Passenger vehicles sold in India during the fiscal year (FY) 2017–2018, ended March 31, were the first to be subject to fuel-consumption standards established by the Ministry of Power.[1] This briefing evaluates the compliance of manufacturer groups with these standards and their readiness to meet more stringent requirements taking effect in FY 2022–2023.

Our analysis is based on annual sales data from Segment Y Automotive Intelligence Pvt. Ltd.[2] and fuel economy data from the Society of Indian Automobile Manufacturers (SIAM) or voluntary reporting by manufacturers[3]. We analyze the fuel efficiency, or carbon dioxide (CO_2) emissions, in the Indian passenger vehicle market based on FY 2017–2018 sales and compare them with prior years' performance. We evaluate new passenger vehicle performance and basic specifications by fuel type and manufacturer group.

1 Ministry of Power. Notification, published in the Gazette of India, Extraordinary [Part II-Sec. 3(ii)], 23 April 2015, https://beeindia.gov.in/sites/default/files/Fuel%20Efficiency%20Notification%20%2823April2015%29.pdf

2 Annual data purchased from Segment Y Automotive Intelligence Pvt. Ltd for fiscal 2006–2007, 2007–2008, 2008–2009, 2009–2010, 2010–2011, 2011–2012, 2012–2013, 2015–2016, and 2017–2018.

3 Fuel economy of vehicles sold in fiscal 2015–2016, 2017–2018 are from SIAM, http://www.siamindia.com/cpage.aspx?mpgid=31&pgidtrail=82 (accessed on August 8, 2018); fuel economy of vehicles sold in FY 2006–2007, 2007–2008, 2008–2009, 2009–2010, 2010–2011, and 2011–2012 are collected by ICCT from voluntary reporting by manufacturers on manufacturers' website or advertisement materials.

Prepared by Zifei Yang

This briefing also evaluates the impact of a flexibility mechanism on manufacturers' compliance with the standards. Flexibility mechanisms under the CO_2 regulation in India are super credits for zero- and low-emissions vehicles and derogation factors for CO_2-reducing technologies.

1. BACKGROUND

India is the fifth-largest passenger vehicle market globally by sales volume, with annual sales in FY 2017–2018 reaching 3.3 million. Deliveries in India expanded at an annual rate of 9% from fiscal 2015–2016 to 2017–2018 (Figure 1) and posted a 10-year annual average growth rate of 8%.

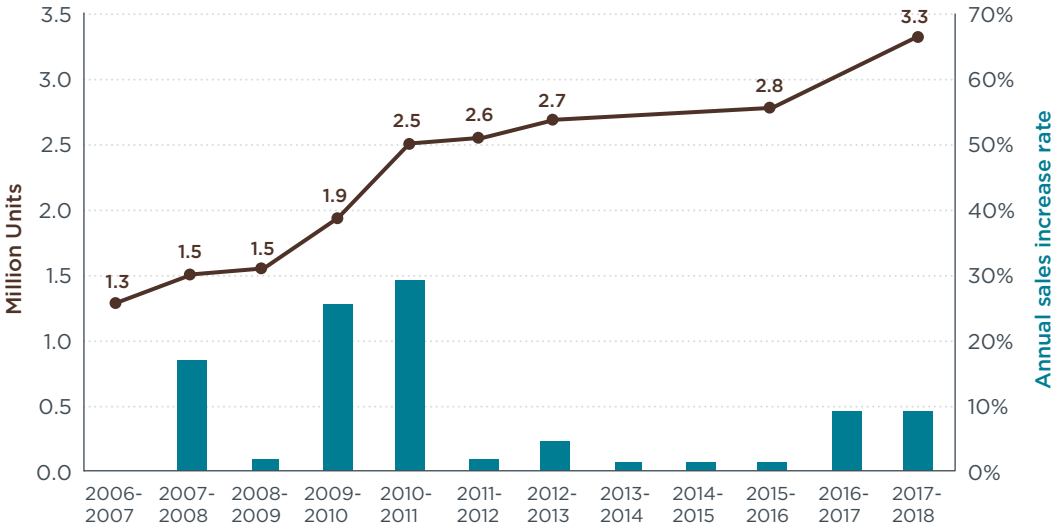

Figure 1 Trend of passenger vehicle sales in India by fiscal years ending March 31.

In 2015, the government of India established corporate average fuel consumption standards for passenger cars taking effect as two-phase targets for FY 2017–2018 and for FY 2022–2023 onward. The standard for a manufacturer is set in terms of gasoline-equivalent liters per 100 kilometers (L/100 km) based on vehicle curb weight. The actual fuel consumption for compliance is measured as grams of CO_2 emissions per kilometer (g/km) during vehicle type approval. The factors for converting consumption of different fuel types into gasoline-equivalent fuel consumption[4] and for converting from gasoline-equivalent fuel consumption to CO_2 emissions[5] are defined in the regulation.

On May 28, 2018, the Ministry of Road Transport and Highways (MoRTH), the agency in charge of implementing the vehicle fuel-consumption standards, proposed provisions for compliance in the document, *Administrative and technical procedure for measurement and monitoring (average) fuel consumption in L/100 km of M1*

4 Fuel types include gasoline, diesel, liquid petroleum gas, compressed natural gas, and electricity.

5 Gasoline Equivalent Fuel Consumption $\left(\frac{\text{liter}}{100\text{ km}}\right)$ = 0.04217 (g/liter) × CO_2 Emissions $\left(\frac{\text{g}}{\text{km}}\right)$

category vehicle with GVW not exceeding 3,500 kg.[6] This document, once finalized, will determine the compliance of manufacturers with the fuel-consumption standards.

This briefing refers to the fuel-consumption standards and the proposed rules for evaluating compliance by manufacturer groups. For the purpose of this analysis, fuel-consumption standards and compliance are reported in terms of equivalent CO_2 emissions.

2. FLEET BASIC SPECIFICATIONS

Figure 2 plots the trend of market share, curb weight, and engine displacement of the new passenger vehicle fleet by fuel type.

Compared with other global markets, India has had a large share of diesel engines in its passenger vehicle fleet. In FY 2010–2011, about 35% of India's passenger vehicle fleet used diesel, and the remainder predominantly gasoline. The market share of diesel vehicles kept increasing until FY 2015–2016, when it reached 50%. However, the diesel market share dropped back to 40% by FY 2017–2018, partially as a result of the phase-out of diesel subsidies.

Market shares for compressed natural gas (CNG) and liquefied petroleum gas (LPG) have been less than 5% since FY 2007–2008 and reached the lowest level in FY 2017–2018. The market share of electric vehicles remains marginal, at 0.02% in FY 2017–2018, down from 0.03% in FY 2015–2016.

The passenger car fleet in India has been historically lighter and less powerful compared with that of most other major markets.[7] In FY 2017–2018, the fleet had an average curb weight of 1,064 kg and an average displacement of 1,303 cc, both down from the 2015–2016 level. The diesel fleet has historically been heavier and more powerful than the gasoline fleet. In FY 2017–2018, the average curb weight for the diesel fleet of 1,304 kg was 45% higher than for the gasoline fleet, and engine size of 1,583 cc, 41% higher. From FY 2015–2016 to FY 2017–2018, the average curb weight and engine size increased for both gasoline and diesel vehicles. However, because of the significant drop in market share of diesel vehicles, the average curb weight of the entire fleet decreased.

6 Ministry of Road Transport and Highway, "Administrative and technical procedure for measurement and monitoring [average] fuel consumption in l/100 km of M1 category vehicles with GVW not exceeding 3500 kg," Draft AMENDMENT No. 7 TO Doc. No.: MoRTH/CMVR/ TAP-115/116: Issue No. 4 (2018), https://araiindia.com/hmr/Control/AIS/1222201655538PMTAPCAFE_MoRTH_11112016_r02_host_web.pdf

7 Zifei Yang and Anup Bandivadekar, 2017 *Global update: Light-duty vehicle greenhouse gas and fuel economy standards* (ICCT: Washington DC, 2017), https://www.theicct.org/node/1474

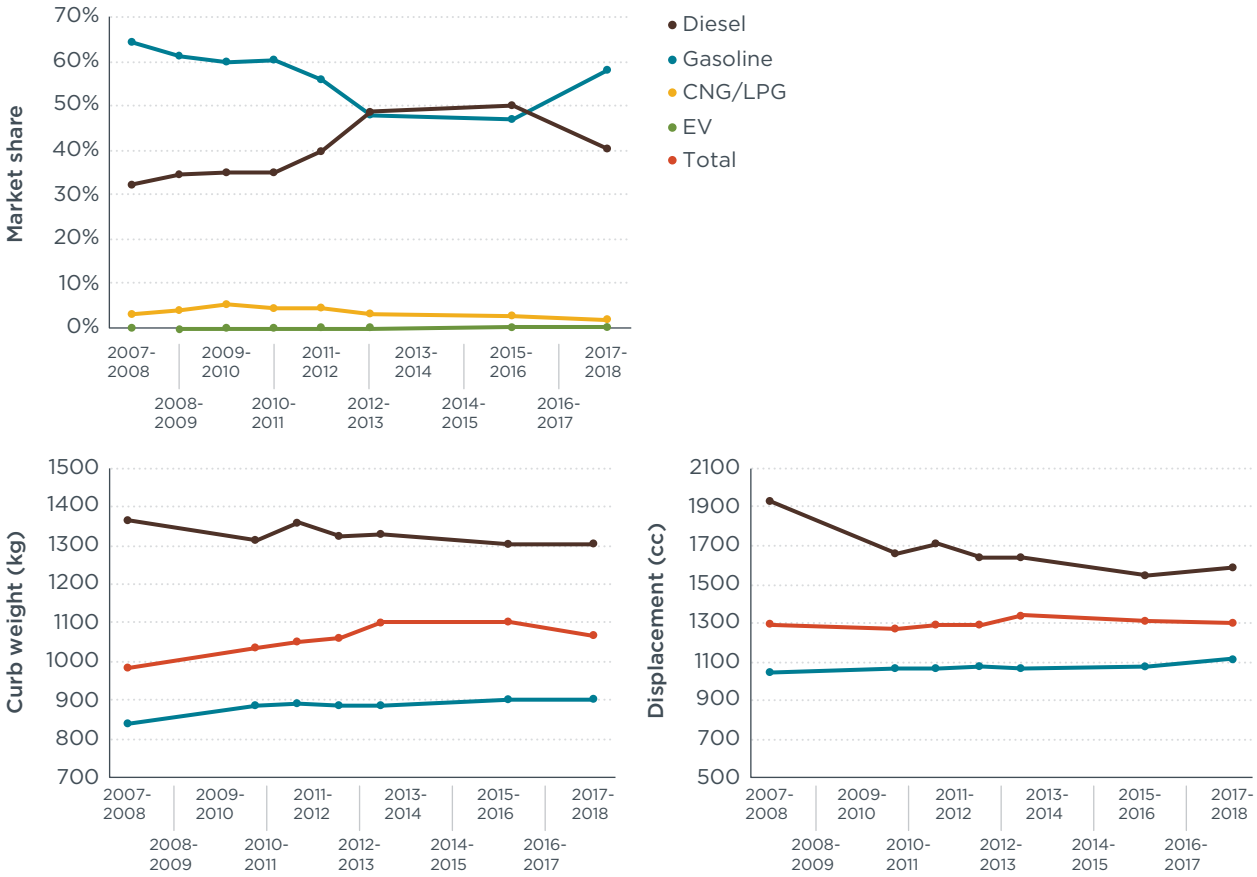

Figure 2 Trend of market share, curb weight, engine displacement by fuel type

The average ratio of passenger cars to utility vehicles and vans was roughly 4:1 between FY 2006–2007 and FY 2011–2012. This ratio shifted suddenly by about 10% toward utility vehicles and vans in FY 2012–2013. While the market share for utility vehicles and vans in 2015–2016 dropped slightly, the market share climbed back in FY 2017–2018, narrowing the ratio of cars to SUVs and vans to 2:1. Figure 3 illustrates the trends in market shares for utility vehicles and vans.

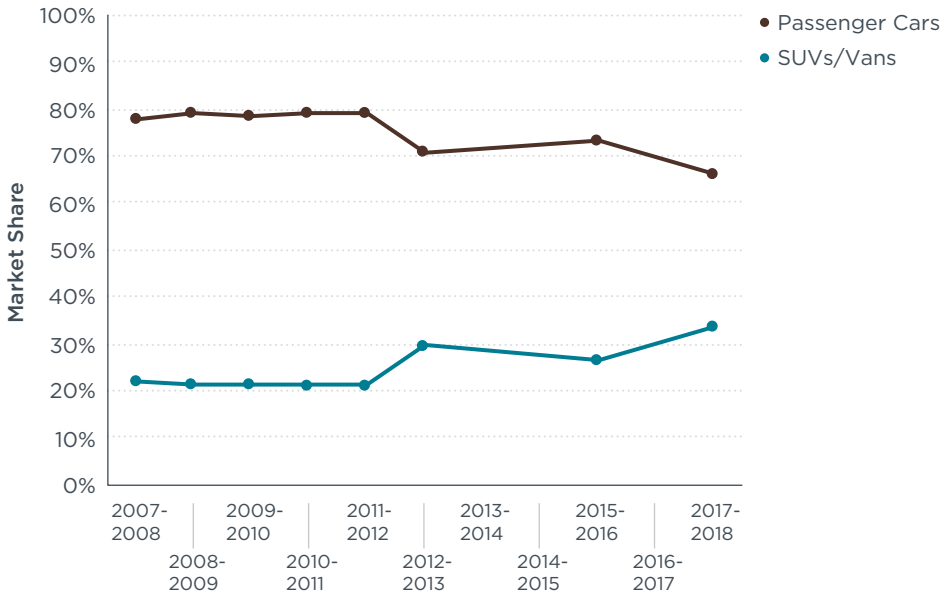

Figure 3 Trend of market share by vehicle type

3. FLEET AVERAGE CO_2 EMISSIONS

Sales-weighted average CO_2 emissions in FY 2017–2018 from new passenger cars in India were 121 g/km, down 2 g/km from the fleet average performance in FY 2015–2016. That works out to an annual CO_2 emissions reduction rate of 0.8%.

Figure 4 plots average CO_2 values and curb weight. From FY 2006–2007 to 2017–2018, average CO_2 emissions decreased 2.1% a year while average curb weight rose 0.7% annually. The three-year period between 2012–2013 and 2015–2016 saw the sharpest decline in CO_2 emissions, averaging 3.4% per year, along with the smallest increase in curb weight of 0.2% a year. In 2017–2018, the fleet dropped significantly in curb weight, mainly reflecting a decrease in market share for diesel vehicles, which are on average heavier than gasoline vehicles. However, the fleet average CO_2 emissions didn't fall from 2015–2016 to 2017–2018 as much as in previous years even as the fleet average curb weight decreased.

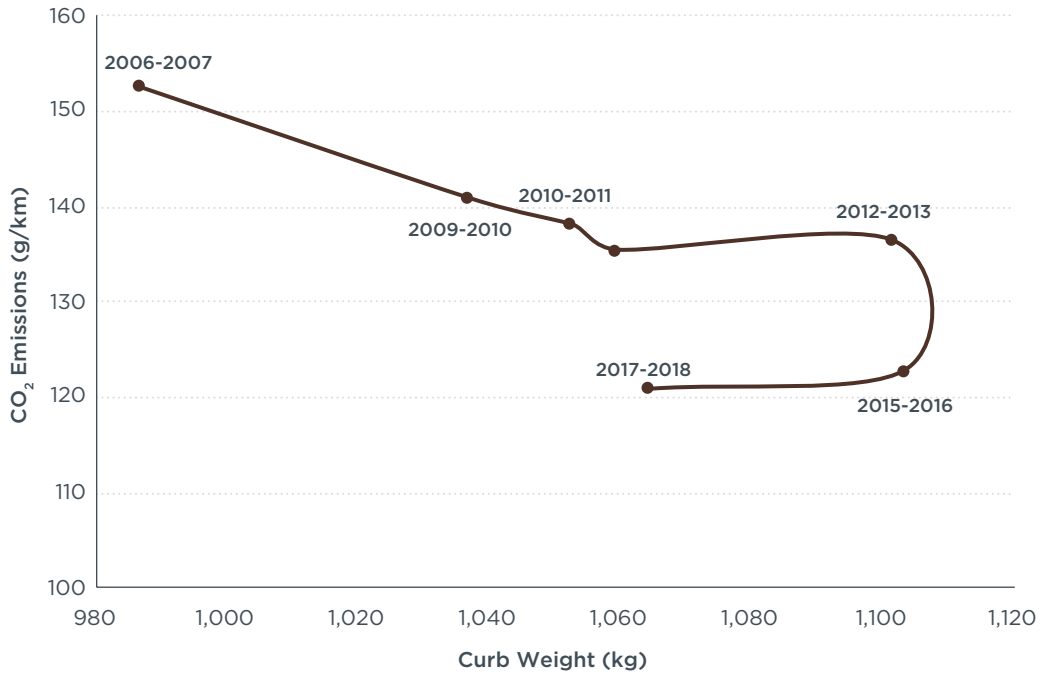

Figure 4 Trend of CO_2 emission and curb weight of passenger vehicles in India

Fleet average CO_2 emissions decreased faster for diesel vehicles from FY 2006–2007 to 2015–2016. But from 2015–2016 to 2017–2018, CO_2 emissions of the diesel fleet increased 2.1% while CO_2 emissions of the gasoline fleet decreased 1.9%. As the gasoline fleet increased in both average curb weight and engine displacement over the same period, the reduction in CO_2 emissions implies improvement in efficiency technologies.

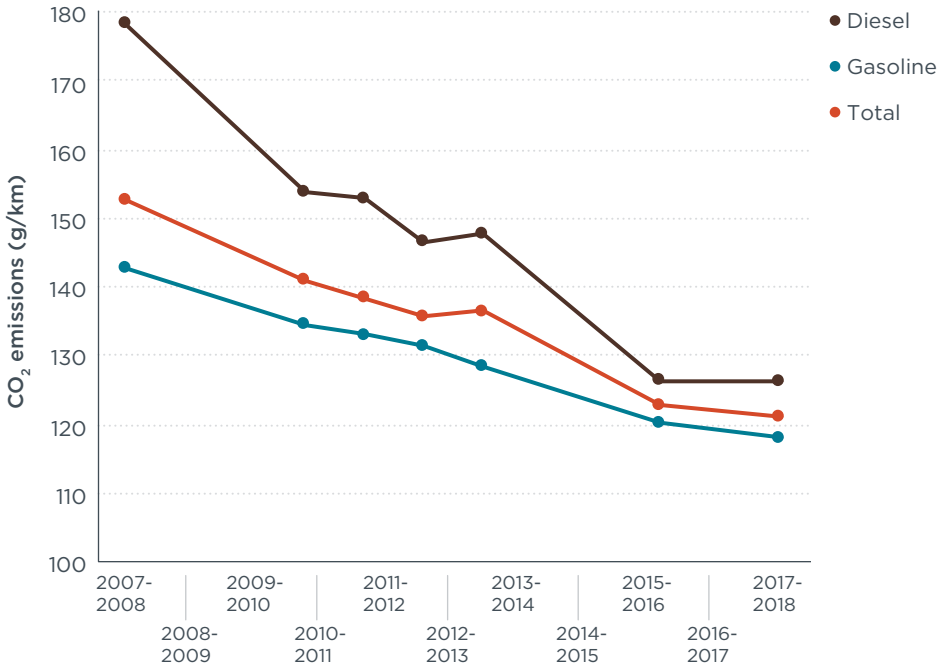

Figure 5 Trend of market share, CO_2 emissions by fuel type

4. CO_2 EMISSIONS COMPLIANCE BY CORPORATE GROUP

According to the proposed compliance provisions, manufacturers belonging to the same corporate group, as defined by a minimum 51% direct shareholding in each manufacturing company by the corporate group, may be considered as one manufacturer for the purpose of complying with fuel-consumption standards. For analysis in this briefing, we follow the definition of corporate groups mirroring the actual vehicle market as closely as possible.[8] The groupings may differ from manufacturer pools adopted by regulators to determine standards compliance in India.

Figure 6 and Figure 7 depict the corporate average emissions levels of all corporate groups as a function of average curb weight before and after the application of flexibility mechanisms. Table 1 details the market share, CO_2 emissions, and compliance with fiscal 2017–2018 and 2022–2023 targets of each corporate group in 2017–2018.

According to Figure 6, Figure 7, and Table 1, Maruti Suzuki has the highest market share of 49.5% and the second-lowest sales-weighted average CO_2 emissions. Renault-Nissan became the lowest CO_2 emissions fleet. Tata Motor, Hyundai, Ford, and Honda followed in the ranking of lowest average CO_2 emissions. The fleet average for CO_2 emissions was ahead of the FY 2017–2018 targets by 9.2% after taking into account the flexibility mechanisms.

Manufacturers not meeting the FY 2017–2018 standard include Aston Martin, Mitsubishi, GM, and Isuzu, which together account for less than 1% of the market. All of them qualify as small-volume manufacturers whose sales total less than 5,000 units a year. This means that they would be considered compliant under the proposed provisions, which set the 2017–2018 target for small-volume carmakers at actual performance.[9] The 2022–2023 targets for these manufacturers will be 17% below their 2017–2018 performance.

When the government released the regulations in 2015, it based the FY 2022–2023 targets on a fleet average weight of 1,145 kg.[10] The regulation required an adjustment of the 2022–2023 standards based on the real average curb weight of the fleet in calendar 2016. In this study, we use the average fleet weight in FY 2015–2016 to define the 2022–2023 targets. The FY 2015–2016 average weight was 1,103 kg, or less than the government estimate for 2022–2023. That means the 2022–2023 targets are less stringent than in the original equation. Moreover, the fleet average curb weight decreased after FY 2015–2016, so the average curb weight of calendar year 2016 used by the government to define the 2022–2023 targets is likely to be lower. Consequently, the final targets are likely to be less stringent than the 2022–2023 targets in our study.

As Figure 7 shows, with consideration of the flexibility mechanism, Volvo has complied with the FY 2022–2023 limit on the basis of FY 2017–2018 sales. BMW, Tata Motors,

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8 Corporate groups were defined as: BMW (BMW, Mini, Rolls-Royce); Daimler (Mercedes, Mercedes-Maybach); FCA (Ferrari, Fiat, Jeep, Maserati); Mahindra and Mahindra (Mahindra, Mahindra Electric, Ssangyong); Renault-Nissan (Datsun, Nissan, Renault); Tata Motors (Jaguar, Land Rover, Tata); Toyota (Lexus, Toyota); and VW (Audi, Bentley, Lamborghini, Porsche, Škoda, Volkswagen).

9 Note that GM announced its decision in 2017 to end sales in India.Nick Bunkley, "GM quits, but India remains a battleground," *Automotive News*, 5 June 2017, http://www.autonews.com/article/20170605/GLOBAL/170609879/gm-leaves-india

10 Fuel consumption target = 0.002 × (curb weight – 1,145kg) + 4.7694.

Ford, and Maruti Suzuki were 0.1% to 5.6% away from achieving the FY 2022–2023 standards. Assuming the fleet average curb weight remains the same as the fiscal 2017–2018 level, the target fleet average CO_2 emissions in FY 2022–2023 will be 112.1 g/km. Therefore, the new passenger car fleet will need to reduce CO_2 emissions/fuel consumption by only 7.5% in the next five years, equal to a 1.5% annual decrease. Considering that India's FY 2022–2023 standards are much less stringent than the EU 2021 standards, there is considerable room for Indian regulators to strengthen fleet fuel-consumption standards.

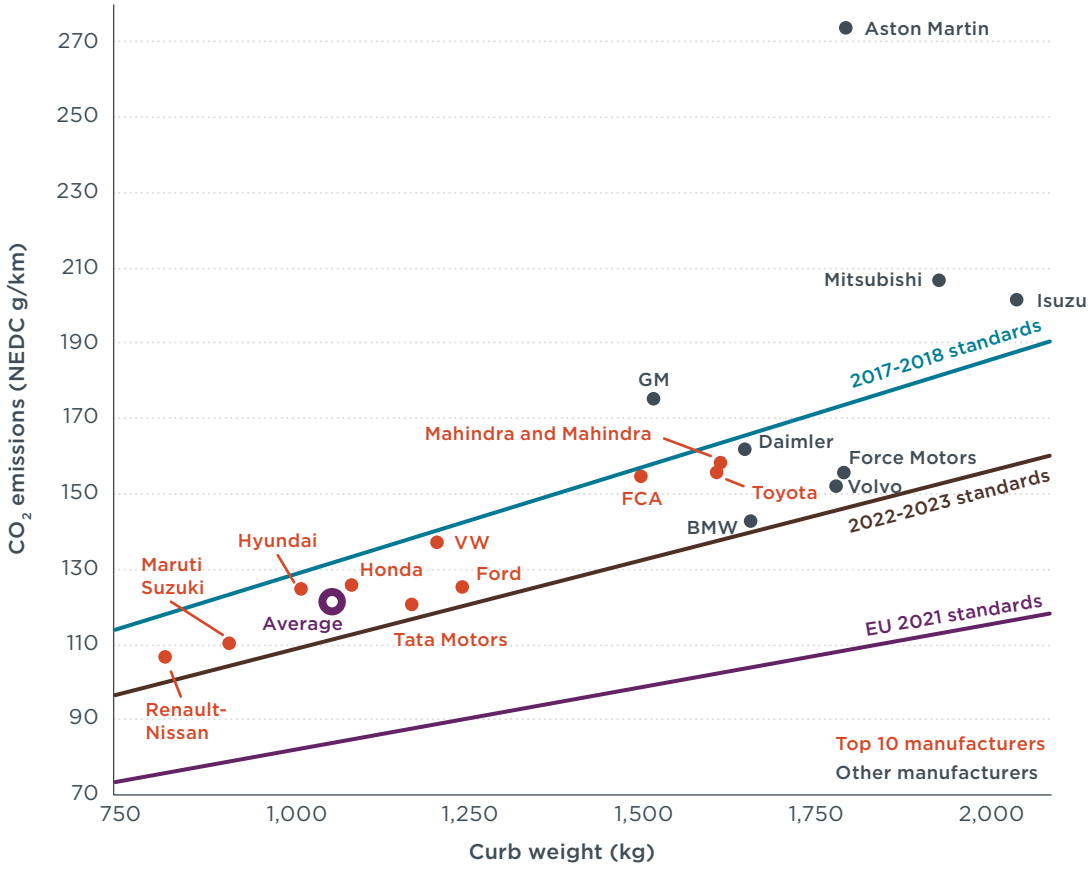

Figure 6 Fleet average CO_2 emissions by corporate group in 2017–2018 (without flexibility mechanism)

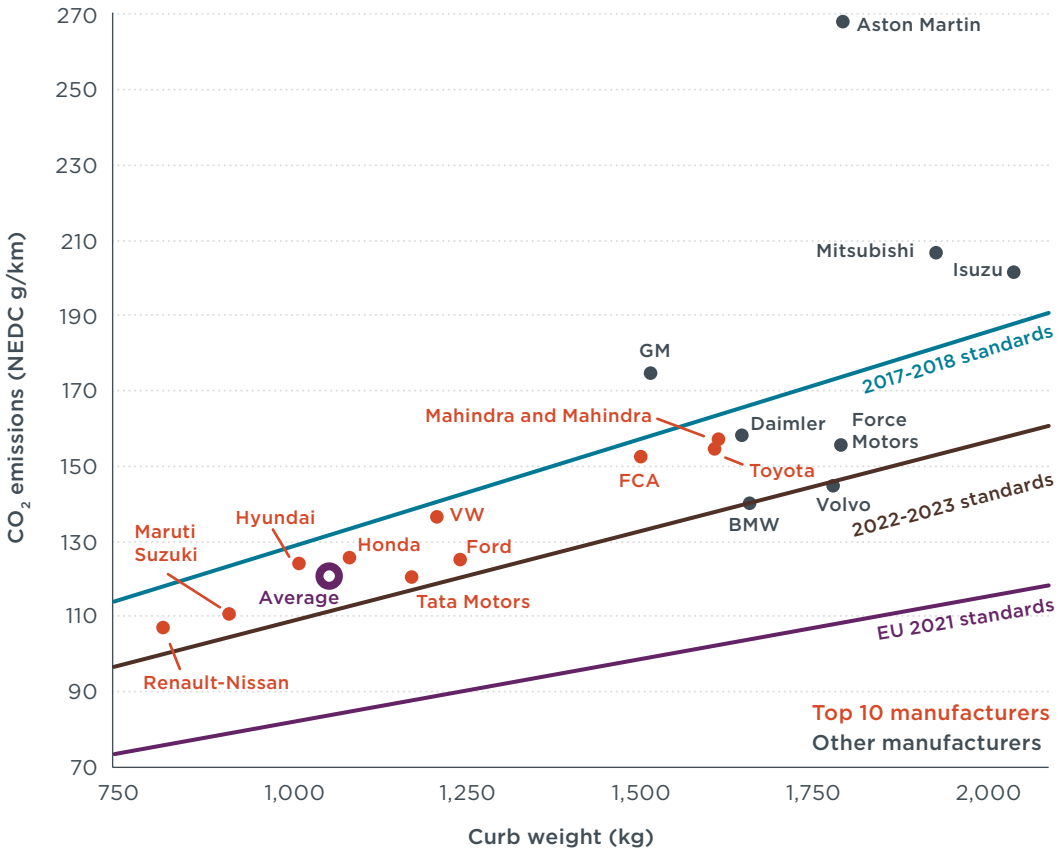

Figure 7 Fleet average CO_2 emissions by corporate group in 2017–2018 (with flexibility mechanism)

Table 1 Market share, average curb weight, and CO_2 emissions performance by corporate group in FY 2017–2018 and compliance with 2017–2018 and 2022–2023 standards

Corporate group	FY 2017-2018 market share	FY 2017-2018 ave. curb weight (kg)	FY 2017-2018 performance w/o flexibility mechanisms (g/km)	FY 2017-2018 performance w flexibility mechanisms (g/km)	FY 2017-2018			FY 2022-2023		
					Target (g/km)	Gap w/o flexibility mechanisms	Gap with flexibility mechanisms	Target (g/km)	Gap w/o flexibility mechanisms	Gap with flexibility mechanisms
Maruti Suzuki	49.5%	918	110	110	123	10.8%	10.8%	104	-6%	-5.6%
Hyundai	16.2%	1,020	125	124	129	3.5%	4.2%	109	-14%	-13.4%
Mahindra and Mahindra	7.3%	1,624	158	157	164	3.4%	4.1%	138	-15%	-13.8%
Tata Motors	6.5%	1,181	120	120	138	13.0%	13.5%	117	-3%	-2.5%
Honda	5.1%	1,093	126	125	133	5.7%	6.2%	113	-12%	-11.1%
Renault-Nissan	4.7%	824	107	107	118	9.6%	9.7%	100	-7%	-6.8%
Toyota	4.2%	1,618	156	154	163	4.7%	5.8%	138	-13%	-11.8%
Ford	2.7%	1,252	125	125	142	12.0%	12.4%	120	-4%	-3.9%
VW	2.1%	1,217	137	136	141	2.5%	3.3%	119	-16%	-14.7%
FCA	0.6%	1,511	155	152	157	1.6%	3.4%	132	-17%	-14.6%
Daimler	0.5%	1,658	162	158	166	2.4%	4.4%	139	-16%	-13.6%
BMW	0.3%	1,668	143	140	166	14.0%	15.7%	140	-2%	-0.1%
GM	0.1%	1,525	175	175	158	-10.8%	-10.6%	133	-32%	-31.3%
Volvo	0.1%	1,790	152	145	173	12.0%	16.3%	146	-5%	0.5%
Isuzu	0.0%	2,051	201	201	188	-7.1%	-7.1%	158	-27%	-27.4%
Force Motors	0.0%	1,800	156	156	174	10.3%	10.3%	146	-7%	-6.6%
Mitsubishi	0.0%	1,938	207	207	182	-13.9%	-13.9%	153	-35%	-35.4%
Aston Martin	0.0%	1,803	274	268	174	-57.5%	-54.3%	146	-87%	-83.4%
Fleet total	100.0%	1,064	121	121	133	8.9%	9.2%	112.1	-8%	-7.5%

The proposed compliance provisions include flexibility mechanisms to reduce compliance costs and foster innovation. The flexibility mechanisms that would influence manufacturers' compliance with standards include super credits for zero- and low-emission vehicles, and derogation factors for CO_2-reducing technologies.[11]

The proposed regulation provides super credits for battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and strong hybrid electric vehicles (HEVs). For the purpose of calculating the corporate average CO_2 performance, a manufacturer uses a volume derogation factor of 3 for BEVs, 2.5 for PHEVs, and 2 for HEVs. This means that a BEV counts as three vehicles, a PHEV as 2.5 vehicles, and an HEV as two vehicles in calculating fleet average CO_2 emissions. The fuel consumption of the electricity driving portion for BEVs and PHEVs is converted from electricity consumption based on an equation provided in the regulations.

Derogation factors for CO_2-reducing technologies aim to reward innovative technologies that produce real-world CO_2 savings beyond what is measured over a standardized test cycle during vehicle type approval. The proposed compliance provisions allow manufacturers to use derogation factors for four CO_2-reducing technologies in calculating the corporate average CO_2 performance. The defined CO_2-reducing technologies include regenerative braking, start-stop systems, tire pressure monitoring systems, and 6-speed or more transmissions. Note that the tire pressure monitoring system is mandatory for safety under U.S. and EU regulations.[12] The CO_2 emissions values will be multiplied by 0.98 for each CO_2-reducing technology applied on the vehicles. In addition, manufacturers could demonstrate the savings of CO_2-reducing technologies (1 g/km or more) beyond the identified list. The total CO_2 reduction due to the derogation factors of listed technologies or additional technologies cannot exceed 9 g/km.

This briefing evaluates only the impact of 6-speed or more transmissions on compliance because of a lack of information on the three other technologies. Note that in 2017–2018, 15% of new passenger cars sold in India were already equipped with 6-speed or more transmissions. Table 2 lists the market share of vehicles equipped with 6-speed or more transmissions by corporate group. Corporate groups that sell luxury or high-end vehicles are 90%–100% equipped with 6-speed or more transmissions, including BMW, Volvo, Aston Martin, Daimler, and FCA.

11 Derogation factors are the equivalent to off-cycle credits under fuel economy standards in other countries.

12 For technologies that are subjective to derogation factors/off-cycle credits in other countries, refer to Table 7 in Yang and Bandivadekar.

Table 2 Market share of vehicles equipped with 6-speed or more transmissions by corporate group

Corporate group	Market share of 6-speed or more transmissions
BMW	100%
Volvo	100%
Aston Martin	100%
Daimler	100%
FCA	91%
Toyota	49%
VW	37%
Hyundai	35%
Honda	31%
Tata Motors	21%
Mahindra and Mahindra	15%
Ford	13%
GM	7%
Renault-Nissan	5%
Murati Suzuki	0%
Isuzu	0%
Force Motors	0%
Mitsubishi	0%
Total	15%

Table 3 summarizes the impact of flexibility mechanisms in CO_2 g/km and the average CO_2 emissions level without and with the flexibility mechanisms. Because our database does not include application information of technologies other than 6-speed or more transmissions, the resulting impact of CO_2-reducing technology credits is underestimated for manufacturers that adopt more than one CO_2-reducing technology. The super credits for PHEVs and HEVs are applied after applying the deterioration factors of CO_2-reducing technologies.

Table 3 Effect of flexibility mechanisms on CO_2 emissions by corporate group. All values in CO_2 g/km over the NEDC

Corporate group	Avg. CO_2 w/o flexibility mechanisms	Impact of flexibility mechanisms			Avg. CO_2 with flexibility mechanisms
		Super-credit	CO_2 reducing technology credit	Total	
Renault-Nissan	106.8	0.0	-0.1	-0.1	106.6
Suzuki	110.2	0.0	0.0	0.0	110.2
Tata Motors	120.4	-0.1	-0.6	-0.7	119.7
Hyundai	124.8	0.0	-0.9	-0.9	123.8
Ford	125.3	0.0	-0.5	-0.5	124.8
Honda	125.8	0.0	-0.7	-0.7	125.1
VW	136.9	0.0	-1.1	-1.1	135.9
BMW	142.9	0.0	-2.9	-2.9	140.0
Volvo	152.3	-4.4	-3.0	-7.4	145.0
FCA	154.7	0.0	-2.8	-2.8	151.8
Toyota	155.6	-0.1	-1.6	-1.8	153.8
Force Motors	155.8	0.0	0.0	0.0	155.8
Mahindra and Mahindra	158.0	-0.7	-0.5	-1.2	156.8
Daimler	161.6	0.0	-3.2	-3.2	158.4
GM	175.1	0.0	-0.2	-0.2	174.9
Isuzu	201.4	0.0	0.0	0.0	201.4
Mitsubishi	206.8	0.0	0.0	0.0	206.8
Aston Martin	273.7	0.0	-5.5	-5.5	268.3
Fleet total	**121.0**	**0**	**-0.4**	**-0.4**	**120.6**

Only four corporate groups—Tata Motors, Volvo, Mahindra and Mahindra, and Toyota—benefit from the super-credit system. However, the impact of the super credit is minimal for most corporate groups. Volvo enjoyed a high super-credit benefit reflecting its relatively high market share of PHEVs (3.2%).

More corporate groups—14 out of 18—benefit from the CO_2-reducing technologies credit. Among them, Aston Martin, Daimler, Volvo, BMW, and Fiat-Chrysler have 90%–100% of their fleet equipped with 6-speed or more transmissions, so they have greater credit benefits than the others. Of course, if other CO_2-reducing technologies are taken into consideration, the credits that manufacturers received in FY 2017–2018 might have been even higher.

In total, Volvo has the highest benefit of 7.4 g/km from the flexibility mechanisms for its compliance with standards, followed by Aston Martin, Daimler, BMW, and FCA. For most manufacturers, most flexibility benefits come from CO_2-reducing technologies credits.

Table 1 shows that the compliance with the FY 2017–2018 standards do not change after taking into account the proposed flexibility mechanisms. However, the flexibility mechanisms enable some manufacturers to be closer to meeting the 2022–2023

standards. For example, Volvo has met its 2022–2023 targets after taking account for the flexibilities in the fleet average calculation.

5. CO_2 EMISSIONS OF TOP 10 VEHICLE MANUFACTURER GROUPS

As Figure 9 illustrates, the top 10 corporate groups in India account for 99% of the new passenger vehicle market. Therefore, we want to take a close look at the CO_2 emissions trends of these 10 corporate groups.

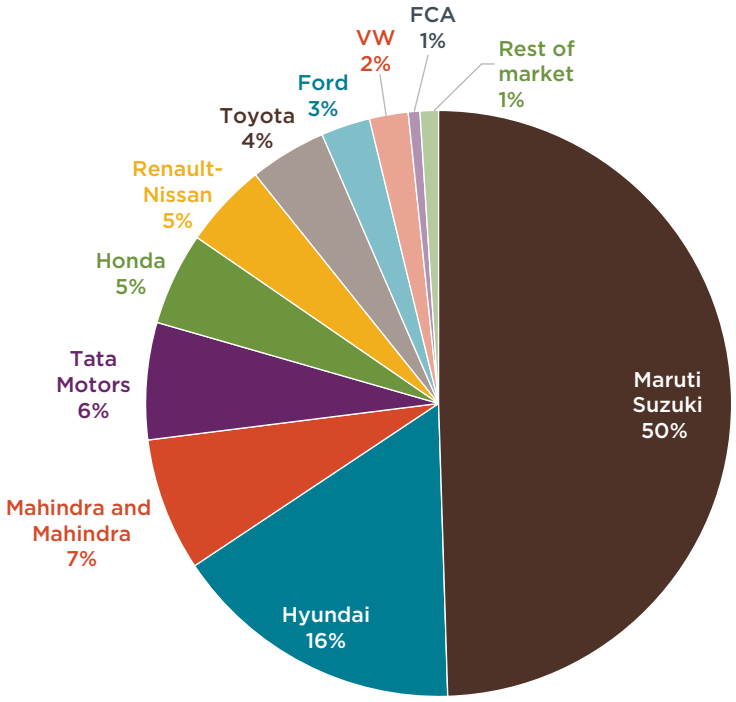

Figure 9 Market distribution by corporate group

Figure 10 compares the fleet average CO_2 emissions of the top 10 corporate groups against standards in FY 2015–2016 and 2017–2018. Except Toyota, nine out of 10 corporate groups had already met the 2017–2018 standards at least two years earlier. Maruti Suzuki, Ford, and Tata Motors are already close to meeting the FY 2022–2023 standards.

It is noticeable that some of these corporate groups were closer to meeting the 2022–2023 standards back in 2015–2016 than in 2017–2018. Among corporate groups that achieved the 2017–2018 standards, the fleet average CO_2 emissions levels of Hyundai, Honda, Ford, and Mahindra and Mahindra increased from the 2015–2016 levels. This implies that the manufacturers are not pressured by the FY 2022-2023 standards, thus lack incentives to advance efficiency technologies on their fleet.

Toyota improved its performance from FY 2015–2016 to 2017–2018 with a big jump in fleet average curb weight and complied with the 2017–2018 standards.

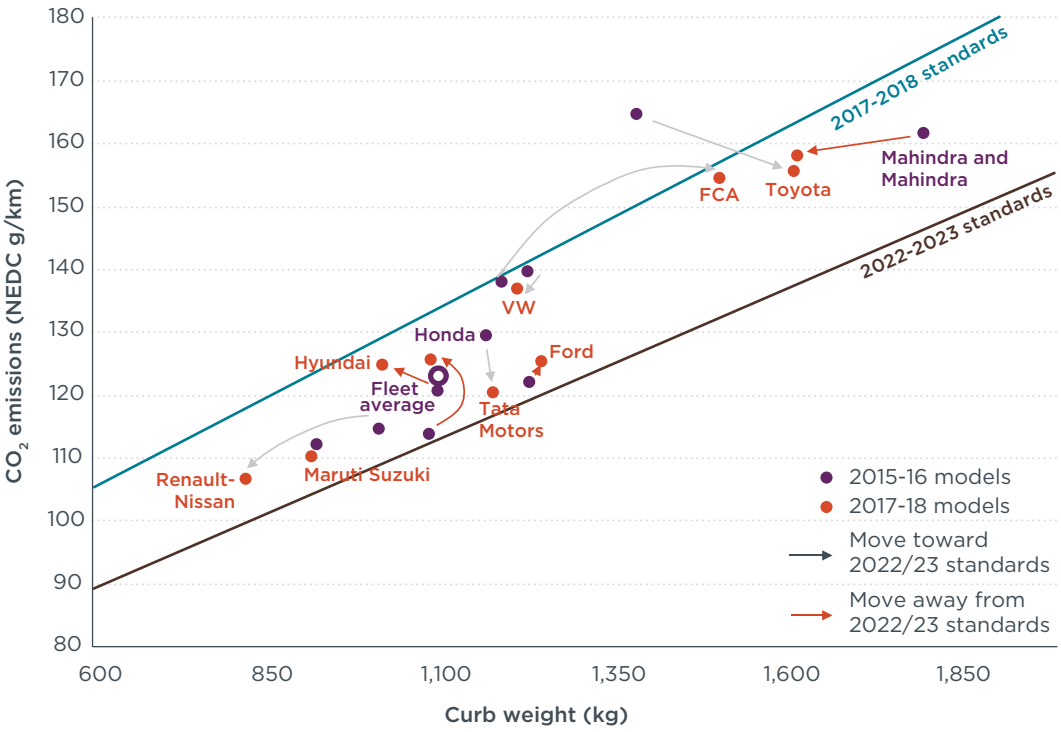

Figure 10 Fleet average CO_2 emissions of top 10 corporate groups, 2015–2016 vs. 2017–2018

6. FURTHER THOUGHTS

FY 2017–2018 was the first year for evaluating compliance with India's first fuel-consumption standards for new passenger vehicles. Based on our analysis, four corporate groups didn't meet the first-year standards, but under the proposed compliance provisions, all of them qualified as small-volume manufacturers that are subject to special, less stringent targets. These corporate groups thus are currently in compliance, but changes in relevant provisions in the final compliance rule might alter their compliance status.

In the draft regulations, if a manufacturer does not meet the fuel-consumption standard in the reporting period, the designated agency shall report such noncompliance to MoRTH and the Ministry of Power/ Bureau of Energy Efficiency for further suitable action. It is not clear in the compliance provisions what measures the regulatory agencies would take and whether noncompliant corporate groups would receive any penalties.

As for the impact of flexibility mechanisms, corporate groups that sell luxury or high-end vehicles benefit more from credits for 6-speed or more transmissions, as 90%–100% of their fleets are equipped with such technology, including BMW, Volvo, Aston Martin, Daimler, and FCA. As 15% of the FY 2017–2018 passenger cars sold in India have already been equipped with 6-speed or more transmissions, regulators should consider excluding this technology from receiving CO_2 credits, as the provision is intended to promote innovation and new technology adoption.

In addition, the tire pressure monitoring system, although its impact is not evaluated in this briefing, is already mandated for safety on vehicles in several big markets.

Although the impact of super credits is minimal for the 2017–2018 fleet, its impact could grow rapidly as the market share of BEVs, PHEVs, and HEVs goes up. Based on the analysis of Volvo, a PHEV market share of 3.2% results in super-credit benefit of 4.4 g/km, or a 2.9% improvement in compliance. If India is expecting rapid uptake of BEVs and PHEVs in the near future to achieve 20% to 40% of the market, regulators should reconsider the super credit for these vehicles in the long term. The uptake of HEVs could be faster as the technology is more mature, so the super credit should be taken out of the compliance rules for fiscal 2022–2023.

More importantly, evidence indicates that the fuel-consumption standards in India are not stringent enough to promote advanced technologies:

- The 2017–2018 fleet average CO_2 emissions are ahead of the targets by 9.0% without flexibility mechanisms and by 9.5% with flexibility mechanisms. Without considering flexibility mechanisms, most corporate groups met the 2017–2018 standards at least two years early.
- From FY 2015–2016 to 2017–2018, CO_2 emissions levels of four out of 10 leading major corporate groups increased and moved away from meeting 2022–2023 standards. This shows that manufacturers are not under pressure to improve technologies to meet next-phase standard.
- Looking ahead, the adjusted 2022–2023 standards are less stringent than they were designed to be in 2015 because the calendar 2016 fleet average weight used to adjust the 2022–23 standards is lower than estimated. Therefore, the fleet has less pressure to meet the 2022–2023 targets.
- The fleet is only 7.3% away from meeting the fiscal 2022–2023 targets after taking flexibility mechanisms into account. That translates into a 1.5% annual CO_2 emissions reduction, which is slower than the annual decrease of 2.1% from fiscal 2006–2007 to 2017–2018. It is also far less than the usual 3.7%–5% annual CO_2 emissions reduction requirements in standards in other countries.[13]
- Some top-selling manufacturers such as Tata Motors and Ford are already within 2.5%–3.9% of meeting the 2022–2023 standards. Volvo has complied with the 2022–2023 standard and BMW is 0.1% away from doing so on the basis of FY 2017–2018 sales.
- Compliance with the standards could become easier over the years as manufacturers benefit more from super credits by increasing BEV, PHEV, and HEV sales and from CO_2-reducing technologies credits by applying technologies that are already mature in the market.

Moving forward, based on the analysis in this briefing, we suggest that regulators:

13 EU 2015–2021, 2021–2025, 2025–2030 standards require 3.7%–5.1% CO_2 reductions annually. U.S. 2017–2025 standards requires 4.4% CO_2 reductions annually. China 2020–2025 standards require 4.4% CO_2 reductions annually.

1. Publish compliance information annually with similar content as in the U.S. and EU reports,[14] including fleet average fuel consumption, average curb weight, the impact of flexibility mechanisms, and compliance status by corporate group.
2. Clarify the enforcement measures for fuel-consumption standards in the coming compliance provisions, especially for noncompliant corporate groups.
3. Strengthen the FY 2022–2023 fuel-consumption standards to increase the annual reduction rate to more than 4% and push for advanced efficiency technologies to catch up with standard stringency in the European Union.
4. Tighten the compliance accounting methods, including the elimination of credits for 6-speed or more transmissions and tire pressure monitoring systems from the CO_2-reduction technologies list; the removal of super credits for HEVs from the fiscal 2017–18 standards; and the halving of super credits for BEVs and PHEVs in the 2022–2023 standards, phasing them out thereafter.
5. Start to develop significantly more stringent post-FY 2022–2023 fuel-efficiency standards.

14 Example of U.S. government report: U.S. Environmental Protection Agency, "Light-duty automotive technology, carbon dioxide emissions, and fuel economy trends: 1975 through 2017," EPA-420-R-18-001 (2018), https://www.epa.gov/fuel-economy-trends; Example of EU government report: European Environment Agency, "Monitoring CO_2 emissions from new passenger cars and vans in 2016," EEA Report No 19/2017 (2017), https://www.eea.europa.eu/publications/co2-emissions-new-cars-and-vans-2016